

Be a Mini MF or LF Broadcaster

Broadcasting can be as much fun as monitoring. There are many things you can do with a legal low power, mini-transmitter under Part 15 of the FCC rules. You can operate without a license with up to 1 watt of dc input power to the last stage of your transmitter from 160 to 190 kHz (low frequency, or LF). In a like manner, operation in the standard AM broadcast band requires no license, provided you use no more than 100 mW of dc input power to the last transmitter stage, from 550 to 1600 kHz (medium frequency, or MF).

Part 15 of the rules define clearly how many microvolts per meter of antenna radia-

tion are legal in lieu of the maximum dc-input power rule. Few experimenters have the instrumentation required for accurately measuring antenna radiation levels, so the dc-input power limitation is best for the tinkerer.

The remaining restriction is the size of the antenna. For operation between 160 and 190 kHz the antenna can be no longer than 50 feet. A maximum of 3 meters (9.9 feet) is specified for the antenna used in the BC band. Conversations I have had with FCC engineers in Washington indicate clearly that the antenna length pertains to a single conductor. The wire contained in loading coils is considered part of the maximum antenna length, so don't

cheat if you want to be legal! In other words, the antenna conductor beyond the feed line can not exceed the foregoing dimensions. Apparently, ground radials and matching networks at the antenna feed point are acceptable.

■ What About Useful Range?

Some experimenters (known as LOWfers)¹ claim "heard" distances as great as 600 miles in the 160-190 kHz LF band. Most of the experimenters operate beacon transmitters that continuously transmit self-assigned call letters. Many use their initials for this purpose. The government does not want ama-

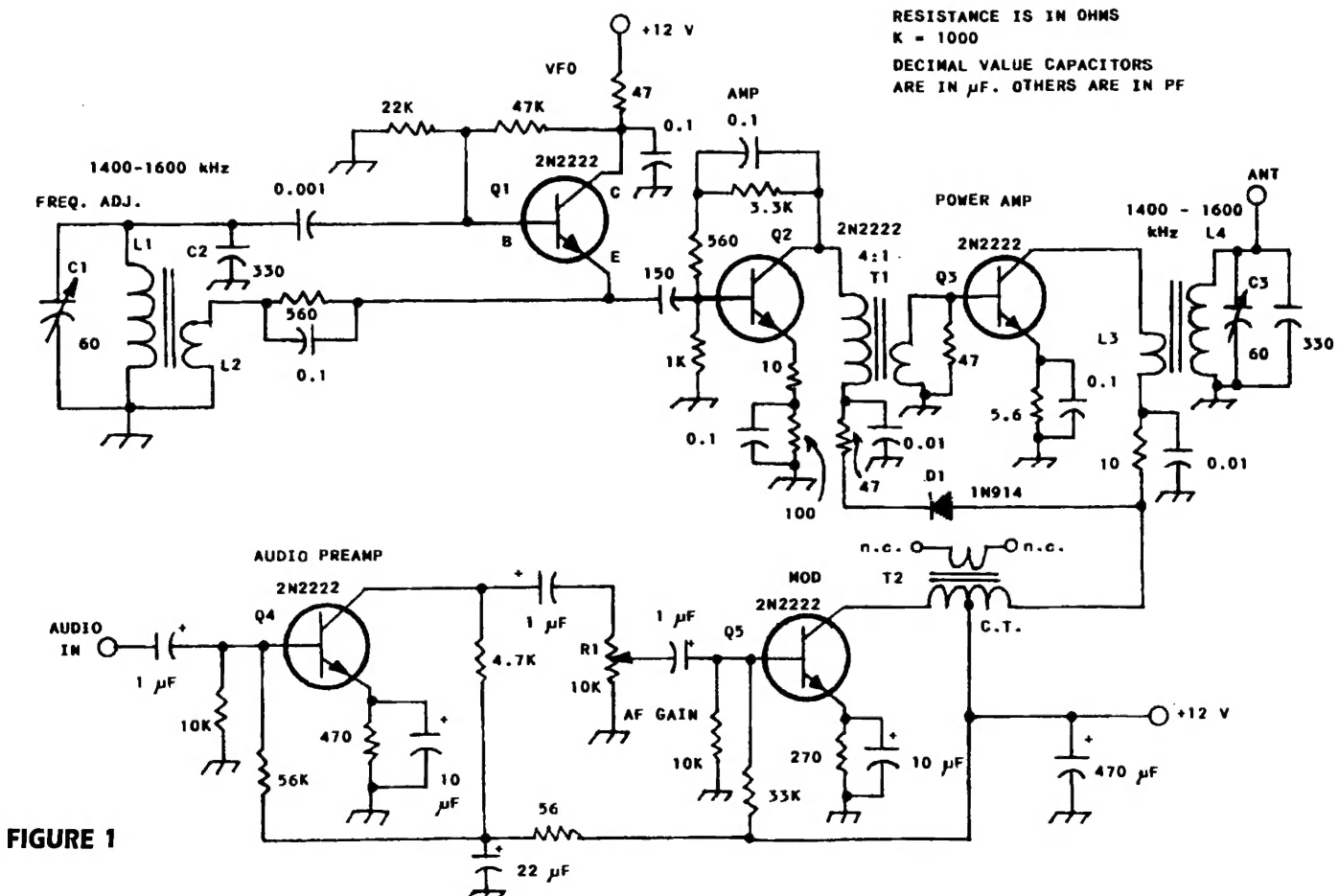


FIGURE 1

Schematic diagram of a 100-mW AM transmitter for unlicensed use under Part 15 of the FCC rules. C1 and C3 are ceramic, mica, or plastic trimmers. Polarized capacitors are electrolytic or tantalum. All others are 50- or 100-V disc ceramic. D1 is a 1N914 diode. L1 consists of 52 turns of no. 28 enam. wire on an Amidon T68-1 (blue) toroid core. L2 is 14 turns of no. 28 enam. wire wound over the grounded end of the L1 winding. L3 has 15 turns of no. 28 enam. wire wound over the grounded end of the L4 winding. L4 uses 52 turns of no. 28 enam. wire on an Amidon T68-1 toroid. Resistors are 1/4-W carbon types. R1 is a 10K-ohm, audio- or linear-taper carbon control. T1 has 14 turns of no. 28 enam. wire on an Amidon FT-50-43 ferrite toroid. The smaller winding consists of 7 turns of no. 18 enam. wire wound over all of the larger winding. T2 is a transistor audio output transformer, 1000 ohms center-tapped to an 8-ohm speaker (Mouser no. 42TC013).

teurs to use their FCC-assigned call signs.

With regard to the 550-1600 kHz MF band, the greatest distance I have achieved for a reliable signal was 1/4 to 1/2 mile while monitoring the signal via my car radio. The tests were conducted with a 10-foot vertical transmitting antenna, in combination with four 60-foot radials and an impedance-matching network at the antenna feed point.

■ Signal Quality

The short antennas permitted for use under Part 15 of the rules are extremely narrow in 2:1 SWR bandwidth. My antenna had a bandwidth of only 3 kHz. This means that AM transmissions are limited in fidelity by the narrow-band response of the antenna. So, don't expect high signal quality if you transmit music. Single-tone audio and voice modulation is not impaired significantly.

■ A Practical Transmitter

Figure 1 shows a simple AM transmitter you can build for a modest outlay of money. Five low-cost transistors are used to create an RF section and a modulator. This transmitter is designed for use from 1400 to 1600 kHz or lower. It is well within the lawful power limit specified for the MF range.

Q1 operates as a self-excited oscillator. Crystal control could be used, but crystals are expensive. C1 is adjusted for the desired operating frequency. Select a frequency that falls between existing BC band signals.

Q2 amplifies the oscillator output signal, which is then routed to the final RF amplifier, Q3. T1 is a tuned circuit that matches the Q3 collector to a 10-foot antenna. C2 is used to resonate the tuned circuit.

Q4 operates as a mic or audio amplifier. Modulation is accomplished by means of Q5. A transistor radio audio output transformer is used as the modulation transformer. A 1000-ohm center-tapped transformer that is designed for use with an 8-ohm speaker is suitable. The output winding is not used. Audio gain control R1 sets the modulation percentage.

D1 allows Q2 to receive modulated dc voltage, but permits only the positive audio peaks to reach the collector of Q3. This ensures that upward modulation occurs (signal increase with modulation). Negative-going audio peaks would reverse-bias Q3 and cause downward modulation (reduced output power during negative-going audio peaks).

■ Construction

The Figure 1 circuit can be assembled on perf board, or you may use point-to-point

wiring between insulating terminal strips. Keep all RF leads as short and direct as practicable. Q1, Q2 and Q3 should be arranged in a straight line in order to keep them sufficiently isolated from one another. This will help to prevent unwanted self-oscillation of Q2 or Q3. Most of the parts for this project are available from Mouser Electronics.² Amidon toroids are used for L1, L2, L3, L4 and T1.³

■ Operation and Use

The 10-foot antenna wire is connected directly to the junction of C3 and L4 (Figure 1). Look for a clear frequency between 1400 and 1600 kHz and adjust C1 until you hear the transmitter signal on an BC-band radio. Now, adjust C3 for maximum signal strength. A radio with an S meter is best for this purpose.

Connect a microphone or tape player to Q4. Adjust R1 for a setting that produces a transmitted signal which is loud, but not distorted or fuzzy. Operation below 1400 kHz is possible if you add capacitance in parallel with C2. Using a trimmer at with greater maximum capacitance at C1 will also lower the operating frequency.

If you aren't interested in operating this transmitter as a beacon for others to monitor, consider employing it for on-the-air code practice with a friend in your neighborhood. A keyed audio oscillator (500 to 1000 Hz tone) may be connected to J1 for this purpose. Two of these transmitters may be used as part of an intercom system between the house and the workshop if two BC-band radios are included. For intercom use tune one transmitter to, say, 555 kHz and the other to 1600 kHz. This will allow you to communicate without muting the receivers.

You can transmit music from your hi-fi system to a remote site, such as your workshop, deck, or a Walkman AM/FM radio. The possibilities are many.

Building, testing and operating this transmitter can be educational as well as entertaining. Who knows? You may become an MF band DX titan if you operate the Figure 1 circuit as a beacon transmitter!

■ Notes

1 — *The Low-Frequency Scrapbook* was written for experimenters who build equipment and operate in the LF and MF bands under Part 15 of the FCC rules. Contact author Ken Cornell, W2IMB, 225 Baltimore Ave., Pt. Pleasant, NJ 08742.

2 — Amidon Assoc., Inc., 3122 Alpine Ave., Santa Ana, CA 92704. Phone: (714) 850-4660 for parts or a catalog.

3 — Mouser Electronics, 958 N. Main St., Mansfield, TX 76063-4422. Phone: (800) 346-6873 for parts or a catalog.

L1 52 turns T68-1(blue) - 31.10 uH
L2 14 turns over ground end of L1 - 2.25 uH
L4 52 turns T68-1 - 31.10 uH
L3 15 turns over ground end of L4 - 2.59 uH
T1 14 turns FT-50-43 ferrite - 86.24 uH
7 turns on top of primary - 21.56 uH